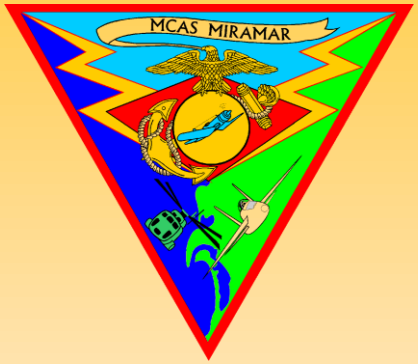
Advanced Grid Technologies Workshop

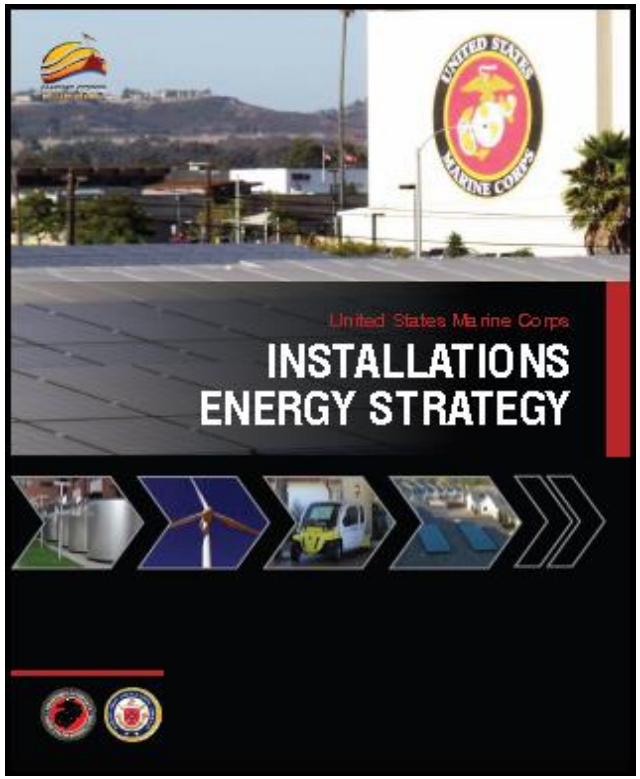


Marine Corps Air Station Miramar Energy Program and Microgrids:

An Operational Perspective on Military Microgrids and Application for Energy Security, Renewables, Efficiency, and Ethos

Mick Wasco, PE, CEM
Installation Energy Manager

Energy Strategy



Lines of Operation

Energy Information

Provide clear feedback to all energy users and emphasize user-controlled reductions.

Energy Efficiency

Invest USMC resources to improve facilities energy efficiency and cut energy intensity.

Renewable Energy

Pursue third-party financing for cost-effective renewable energy resources.

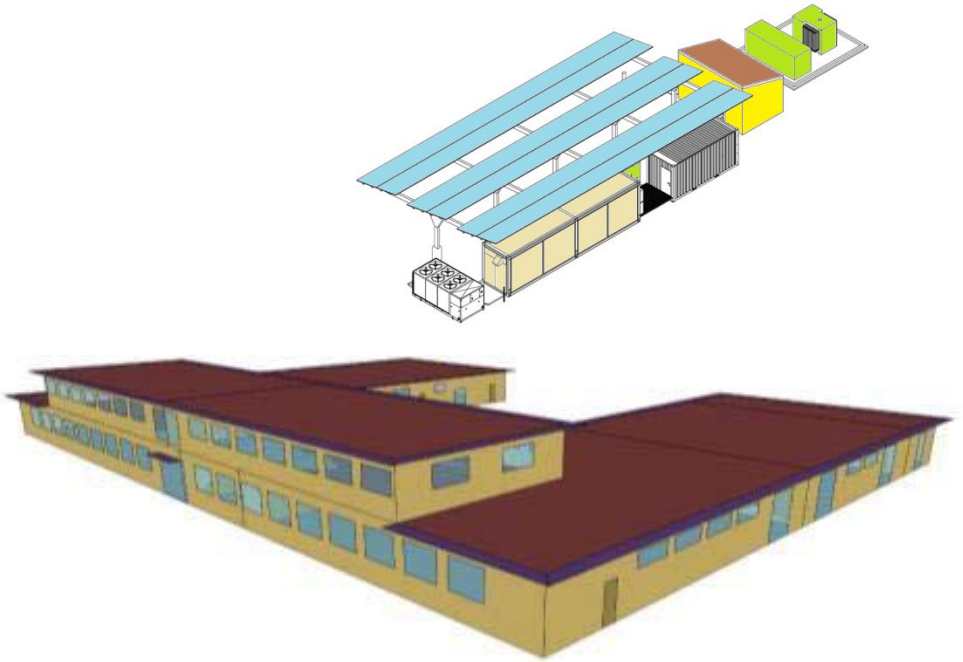
Energy Security

Upgrade and integrate energy infrastructure to improve security and mitigate risk.

Energy Ethos

Recognize energy as a strategic resource by All Hands, 24/7/365, from Bases to Battlefield

Microgrids



Installation Level Microgrid

- Energy Security Microgrid for Critical Facilities
- FY2014 ECIP Project
- Programmed Cost $18M
- Projected award in FY16

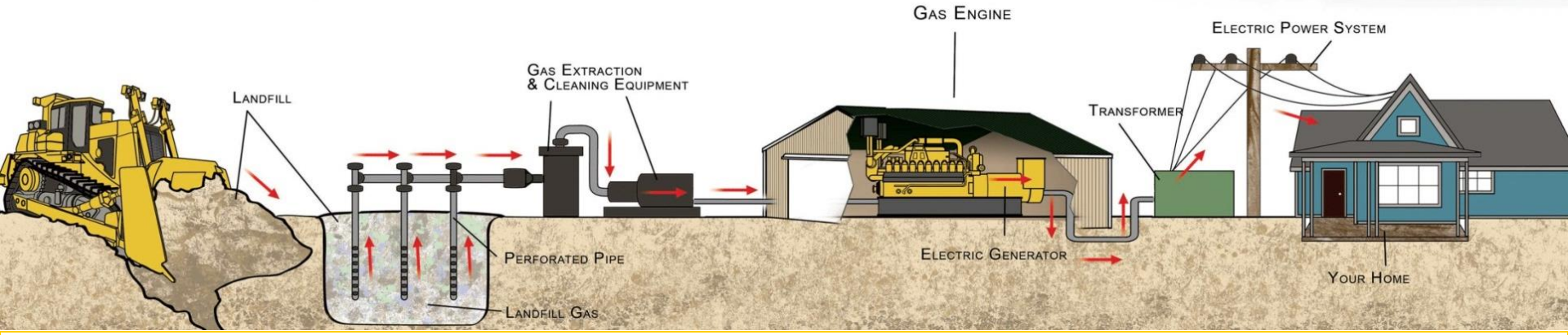
Building Level Microgrid

- Zinc Bromide Flow Battery Installation for Islanding and Backup Power
- FY2012 ESTCP Project
- Cost ~$3M
- Projected completion September 2015

Renewables

City of San Diego

FORTISTAR



P-906 Microgrid Overview

Project Details

- **Energy Security Microgrid for Critical Facilities**
- **FY2014 ECIP Project**
- **Programmed Cost $18M**
- **Projected award in FY16**

Project Description

- Install diesel (4 MW) and natural gas (3 MW) generation with the ability to power 100% of the flight line and support facilities (100+ facilities = 4 – 7 MW)
- Incorporate existing onsite landfill power generation (3.2 MW) and existing PV generation (1.3 MW) into microgrid islanding as much as feasible.
- Enable generation to participate in demand response during grid connection.
- Build Energy Operations Center
- Cyber Security accreditation through Risk Management Framework

Project Goals

1) Energy Security (Back-up Power)
2) Renewable Integration
3) Revenue/Grid Support

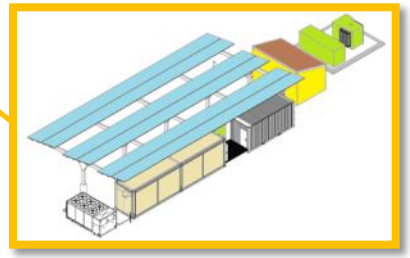
P-906 Microgrid Map

Microgrid Backup Power Plant

- 4 MW Diesel Generator Set
- 3 MW Natural Gas Generator Set
- Central Microgrid Controller
- Energy Storage

Energy Operations Center

356 kW Thin-Film PV Roof Systems



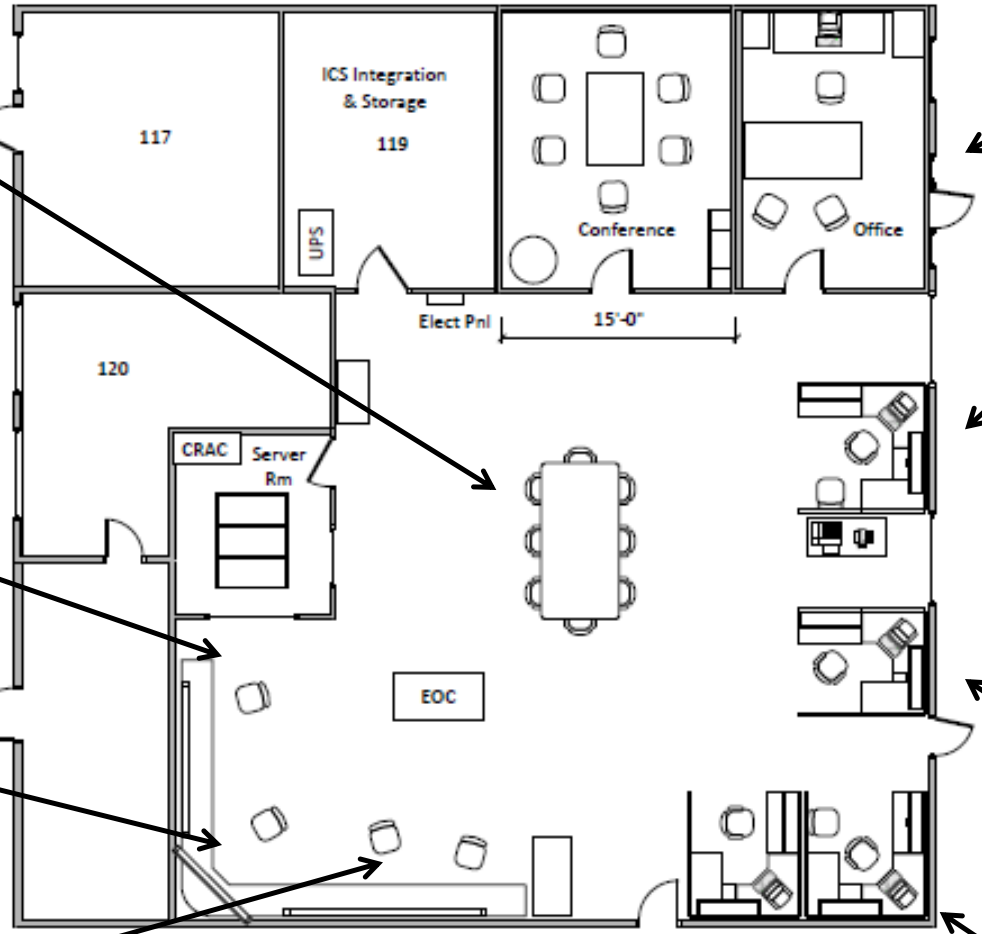
250 KW / 1 MWH Battery Storage

3.2 MW Landfill Gas Energy Plant

435 kW PV Carports

511 kW PV Carports

Energy Operations & Resource Center



Technology/Equipment Testing

"Calsense" Smart Irrigation System

Installation Microgrid Controller & SCADA Station

IPEM Controller (B6311 Microgrid)

Tenant Training/Behavioral Awareness/Outreach

Installation Energy Management

Area Wide Energy Management System (HVAC Controls)

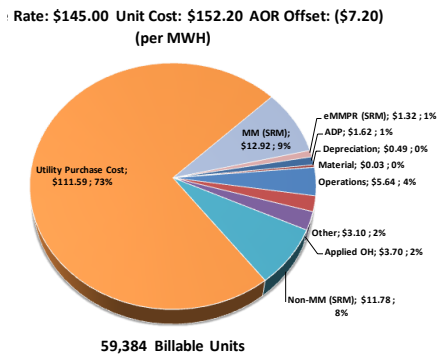
Advanced Metering Infrastructure

Project Development/Energy Auditing

Operations

Grid Connected Mode – eliminate energy waste & increase efficiency (95%)

- **Operate Generation Assets**
  - Execute Demand Response with SDG&E
    - Base Interruptible Program estimated savings $252K/year
  - Peak Shaving/Load Management
- **Renewable Energy Systems**
  - Monitoring and analysis
- **Advanced Metering Infrastructure**
  - Real-time monitoring
  - Analytics, trends, and reports for buildings
  - Identify errors, leaks, or spikes in consumption
- **Area Wide Energy Management System (DDC)**
  - Corrective action on building equipment operation
  - Demand Load Limiting Response



Testing and Maintenance Mode – routine testing and maintenance (4%)

- **Partnering with NAVFAC Utilities for Gov't O&M**
- Quarterly all inclusive tests paired with operational responsive drills

Islanded Mode – emergency situation (<<1%)

- Power critical building loads at 100% power
- Coordinate with the installation Emergency Operations Center (Air Ops)

Demand Response

Grid Connected Mode – eliminate energy waste & increase efficiency (95%)

- **Operate Generation Assets**
  - Execute Demand Response with SDG&E
    - Base Interruptible Program estimated savings $252K/year

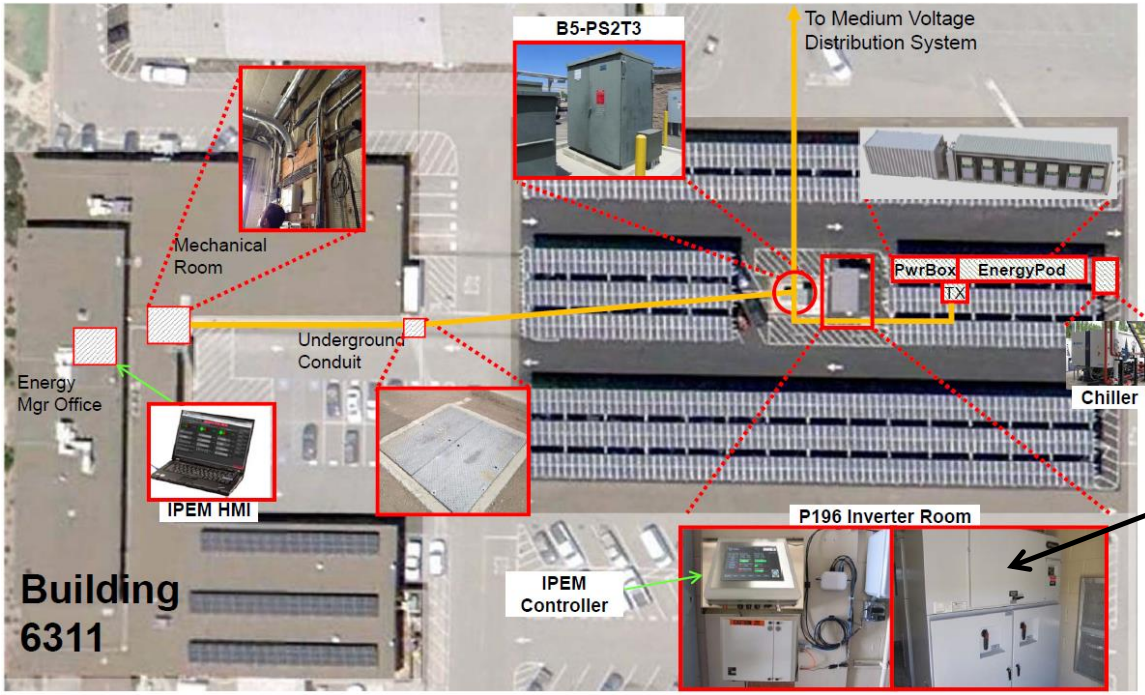
"Expand Microgrid functionality for best return as opposed to just islanding" – ASN McGinn

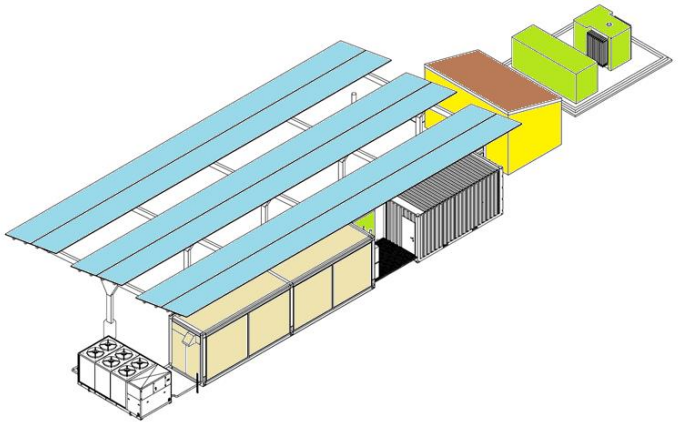
CPUC: Emergency Generation Limitations:
"Participating customers are prohibited from achieving energy reductions by operating backup or onsite standby generation"

UCSD

Microgrid needs to support of the "macro-grid"… - Byron Washom

Battery Demonstration





AE Invertors: Communication cards updated to enable PV curtailment and modbus over IP comms

Testing AE invertors and Primus power electronics with Raytheon IPEM microgrid controller at NREL's ESIF facility with battery and load simulator prior to installation at Miramar

Current Pictures

Ethos

Thank you

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